# Endovascular Treatment of Ruptured Anterior Communicating Artery Aneurysms

## Results and Technical Considerations

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**Key words:** anterior communicating artery aneurysm, Guglielmi Detachable Coil, subarachnoid haemorrhage

***Summary***

*The aim of this paper is to provide a review of our experience in using the endovascular treatment of ruptured anterior communicating artery (ACoA) aneurysms. Between March 1997 and May 2004, 211 ruptured aneurysms were treated with Guglielmi detachable coil (GDC) system in Mito Medical Center, 73 were located at the ACoA. Two cases were incomplete embolization, and performed microsurgical clipping. In the initial embolization for the 71 aneurysms, complete occlusion was achieved in 44 aneurysms, neck remnant in 11 aneurysms and body filling in 16 aneurysms. Intra-operative complication was occurred in six cases (8.2%).*

*Aneurysm perforation was occurred in three cases (4.1%), thromboembolic complication was occurred in three cases (4.1%). Acute rebleeding were observed in two cases (2.7%). Endovascular treatment is an effective technique for treating ACoA aneurysms, and 3D-rotational angiography is important diagnostic tool for evaluating the ACoA complex.*

### Introduction

Aneurysms located along the anterior communicating artery (ACoA) are the most frequently ones of the cerebral aneurysms, representing 30-40% [9].

The surgical approach to treating ACoA aneurysms may be difficult, because of arterial relationships and closely located at the hypothalamus.

Satisfactory clip occlusion with ACoA aneurysms while attempting to preserve the perforating arteries and maintain the patency of the ACoA can be problematic [6]. Since introducing the endovascular treatment of ruptured cerebral aneurysms using Guglielmi detachable coil (GDC) has produced encouraging results in preventing rebleeding in the acute phase of subarachnoid haemorrhage (SAH) [2,7,8]. The aim of this paper is to provide a review of our experience in using the endovascular treatment of ACoA aneurysms.

### Clinical Material and Methods

Between March 1997 and May 2004, 211 ruptured aneurysms were treated with GDC in Mito Medical Center. Seventy-three ACoA aneurysms (34.6%) were treated with GDC (table 1). Indications of GDC treatment for cerebral aneurysm as follows: 1) Neck of the aneurysms easily identified among surrounding vessel. 2) Aneurysms measuring more than 2 mm and less than 15 mm. 3) Not broad neck and not shallow body of the aneurysm. 4) No organized thrombus in the aneurysm. 5) No massive intracranial haematoma. 6) No severe arteriosclerosis [7].

All of the GDC treatments were performed under general anesthesia, and spinal drainage was inserted before the GDC treatment. Systemic anticoagulation with heparin was used in selected cases to decrease the rate of embolic complications. All aneurysms were treated using the GDC system until dense packing for preventing the rebleeding was achieved [7].

The state of aneurysmal obliteration was evaluated using the 3D-rotational angiography and control angiography in multiple projection. The angiographical results of the treatment were categorized as follows: complete occlusion; CO (no contrast filling of the dome, body, or neck of the aneurysm), neck remnant; NR (some contrast filling into the part of the neck of the aneurysm), and body filling; BF (some contrast filling into the dome).

Regarding the outcome, all patients were evaluated at discharge according to the Glasgow Outcome Scale (GOS). We categorized a patient as having a favorable outcome if the GOS score was Good recovery (GR) and Moderate disability (MD), an unfavorable outcome was Severe disability (SD), Vegetable state (VS) and Death (D).

Table 1 **Location of aneurysm.**

| Location of aneurysm | No. of cases |
|---|---|
| Anterior communicating artery | 73 |
| Distal anterior cerebral artery | 13 |
| Internal carotid artery | 65 |
| Middle cerebral artery | 27 |
| Basilar artery | 16 |
| Vertebral artery | 13 |
| Others | 6 |
| Total | 211 |

Table 2 **Relationship between Hunt & Kosnik grade before endovascular treatment and Glasgow outcome scale at discharge. A) All of the aneurysm cases. B) ACoA aneurysm cases.**

| | GR | MD | SD | VS | D | |
|---|---|---|---|---|---|---|
| I | 18 | 2 | 1 | | | 21 |
| II | 60 | 5 | 4 | 2 | 1 | 72 |
| III | 47 | 4 | 3 | 1 | 4 | 59 |
| IV | 17 | 9 | 10 | 3 | 8 | 47 |
| V | 3 | 1 | 2 | 2 | 4 | 12 |
| Total | 145 | 21 | 20 | 8 | 17 | 211 |
| *A) All of the aneurysms cases* | | | | | | |
| | **GR** | **MD** | **SD** | **VS** | **D** | |
| I | 12 | 1 | | | | 13 |
| II | 14 | 1 | 2 | 1 | 1 | 19 |
| III | 9 | 2 | 2 | | 3 | 16 |
| IV | 6 | 8 | 6 | 1 | | 22 |
| V | 1 | | 2 | | | 3 |
| Total | 43 | 12 | 12 | 2 | 4 | 73 |
| *B) ACoA aneurysms cases* | | | | | | |

## Result

Two cases were incomplete embolization, and performed microsurgical clipping. In the initial embolization for the 71 aneurysms, CO was achieved in 44 aneurysms, NR in 11 aneurysms and BF in 16 aneurysms. Intra-operative complication was occurred in six cases (8.2%). Aneurysm perforation was occurred in three cases (4.1%), thromboembolic complication was occurred in three cases (4.1%). Acute rebleeding were observed in two cases (2.7%). Peri-operative complication related mortality and morbidity was 2.8% and 5.5%.

In the entire population (211 patients) of the ruptured cerebral aneurysms, 166 patients (79%) attained a favorable outcome (GOS: GR, MD). Among ACoA patients (73 patients), 55 patients (75%) attained a favorable outcome. The rate of patients with favorable outcome was not significantly different between the entire patients and ACoA patients (table 2).

## Representative Case Illustrations

Case 1: A 65 year-old-woman with Hunt & Kosnik grade 4 subarachnoid haemorrhage. The left carotid angiogram revealed an acutely ruptured ACoA aneurysm. To confirm the working angle was difficult, because the aneurysm neck was demonstrated to have extreme angle in craniocaudal angulation that were unreached by the C-arm. Hyperextending the head of the patient, and this enabled to find a satisfactory working angle for endovascular treatment. The aneurysm was successfully treated using the GDC system (figure 1).

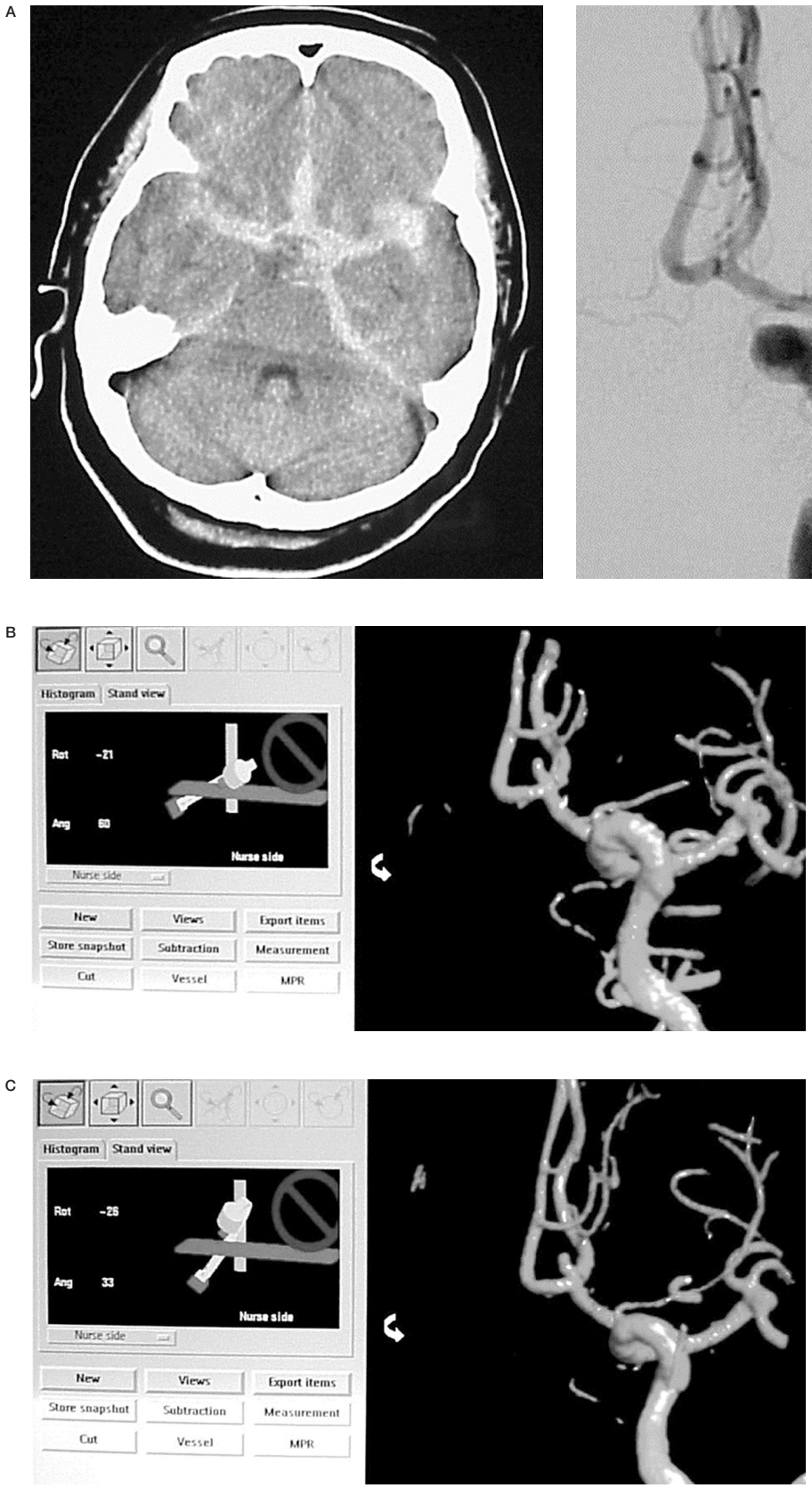


*Figure 1* Case 1: 65-year-old woman. ACoA ruptured aneurysm. A) Computed tomography on admission. B) 3D rotational angiography. The working angle was unreached by the C-arm. C) 3D rotational angiography. After hyperextending the head of the patient. D) Post-embolization left carotid angiogram. (Left rostral oblique view, working angle)

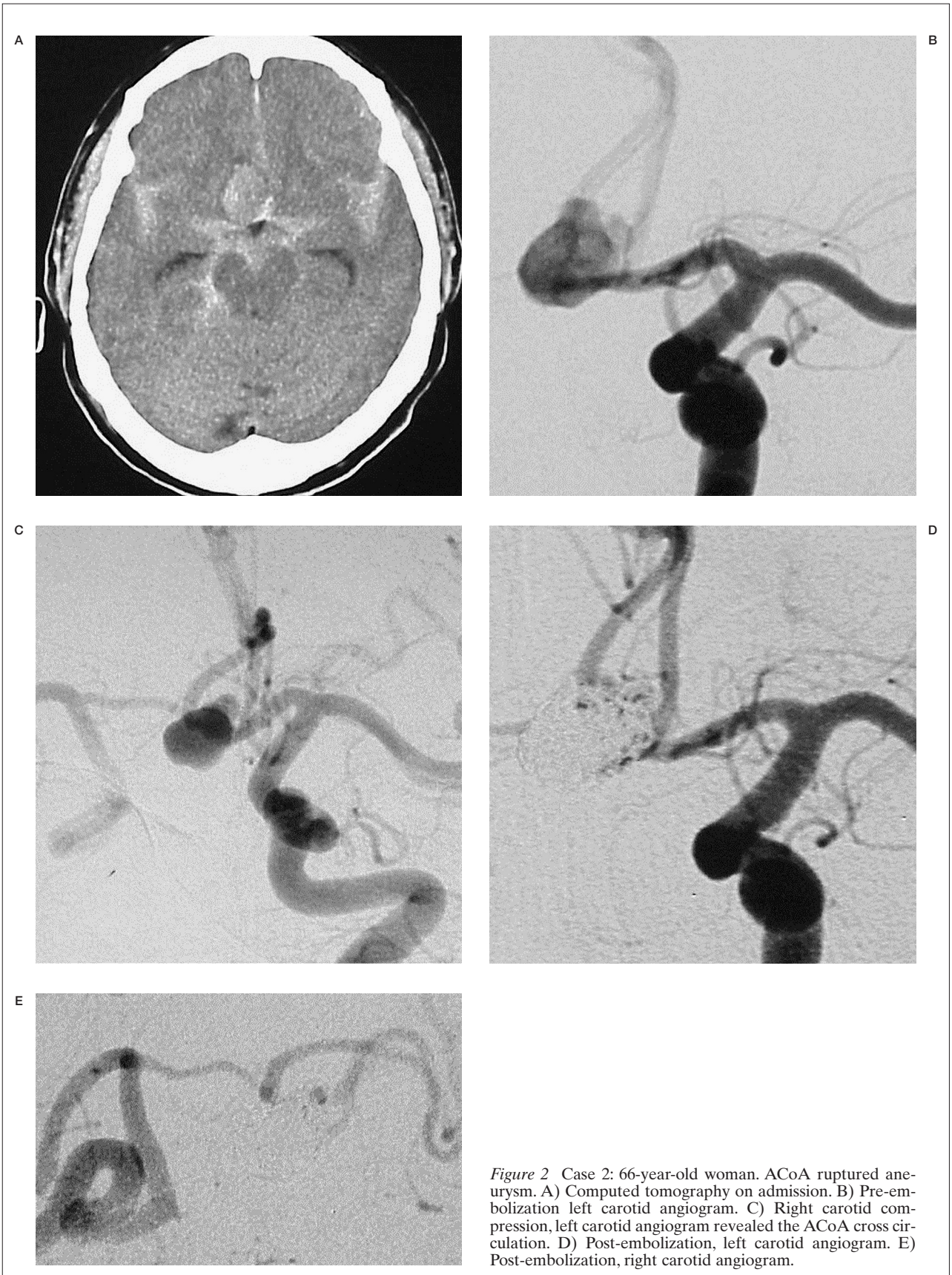


*Figure 2* Case 2: 66-year-old woman. ACoA ruptured aneurysm. A) Computed tomography on admission. B) Pre-embolization left carotid angiogram. C) Right carotid compression, left carotid angiogram revealed the ACoA cross circulation. D) Post-embolization, left carotid angiogram. E) Post-embolization, right carotid angiogram.

Case 2: A 66 year-old-woman with Hunt & Kosnik grade 2 subarachnoid haemorrhage. She was terminal hepatocirrhosis. The left carotid angiogram revealed an acutely ruptured ACoA aneurysm. The aneurysm was arising from the midportion of the ACoA. Right carotid compression, left carotid angiogram revealed the ACoA cross circulation. GDC embolization was performed, the aneurysm with ACoA was obliterated. The left carotid angiogram revealed complete occlusion at the anterior part of the aneurysm. Right carotid angiogram revealed a slight body filling at the posterior part of the aneurysm and ACoA. Right anterior cerebral artery was patent. The patient condition was not changed and discharged without a neurological deficit (figure 2).

## Discussion

The endovascular treatment appears to be an effective and safe alternative treatment for patients with ruptured cerebral aneurysms [2,7,8]. Regarding those on the ACoA, the efficiency of endovascular treatment has been successfully demonstrated. A single study specifically concerned with the endovascular treatment of ACoA aneurysms was reported by Moret et Al. [4]. They reported technical complication rate of 8.3% for clotting and 2.7% for aneurysm rupture, which were responsible for morbidity in 2.7%. In our series, intra-operative complication was occurred in 6 cases (8.2%), which were responsible for mortality and morbidity in 2.8% and 5.5%. We have experienced four aneurysm perforations (1.9%) on the treatment of 211 ruptured aneurysms. Regarding the location of aneurysm perforation, three of four were located on the ACoA [3]. Technical difficulty for ACoA aneurysms is sharp angle turn at the junction of the internal carotid artery and the anterior cerebral artery. Many of ACoA aneurysms cases, distal cathetelization is quite difficult, and may cause excessive tension of the micro-catheter or micro-guidewire.

Delineating the aneurysm neck is important for endovascular treatment, and multiple projections are often required. 3D-rotational angiography analysis allowed us to easily find at best working angle that clearly demonstrated the aneurysm neck and could be used to perform the endovascular treatment [1]. In our experience of using the 3D rotational angiography system, useful angiographic positions for ACoA aneurysms are transorbital oblique or submentovertex views. However, that every patient is different and that subtle changes in these views are often necessary to eliminate artifact or adjust for anatomic variations.

Yasargil described the ACoA aneurysm location, 52.5% of the aneurysm arose from the junction of the left A1 segment and ACoA, 28.8% form a similar position on the right corner, 18.7% was based on the midportion of the ACoA [9]. On the treatment of ACoA aneurysms, we have to mention about the perforating arteries arising from the ACoA. The aneurysms arising from the junction of the A1 segment, recurrent artery of Huebner is important one.

The aneurysms arising from the midportion of the ACoA, hypothalamic arteries are important perforator. Perlulmutter and Rhoton reported that 90% of perforating arteries arising from the ACoA were branched on the superior and posterior facies [5]. One side coil packing of the ACoA, these perforating arteries were preserved from opposite ACoA blood flow. In such a case, if the opposite anterior cerebral arterial blood flow was patent, we thought the aneurysm coil occlusion with ACoA might be possible therapeutic option. However, this therapeutic option has many limitations, need an accurate anticoagulation or antiplatelet therapy, and difficulty for tight packing of the aneurysm neck. 3D-rotational angiography is necessary for determined to the therapeutic option.

## Conclusions

In this study, we evaluated the therapeutic results attained for ACoA aneurysms in a consecutive series. If the opposite anterior cerebral arterial blood flow was patent, the aneurysm coil occlusion with ACoA might be possible therapeutic option. Endovascular treatment is an effective technique for treating ACoA aneurysms, and 3D-rotational angiography is important diagnostic tool for evaluating the ACoA complex.

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**Abbreviations used in this paper:**

SAH= subarachnoid haemorrhage,
GDC = Guglielmi Detachable Coil,
ACoA = anterior communicating artery,
CO = complete occlusion, NR = neck remnant,
BF = body filling
GR = good recovery, MD = moderate disability,
SD = severe disability, VS = vegetable state, D = death

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